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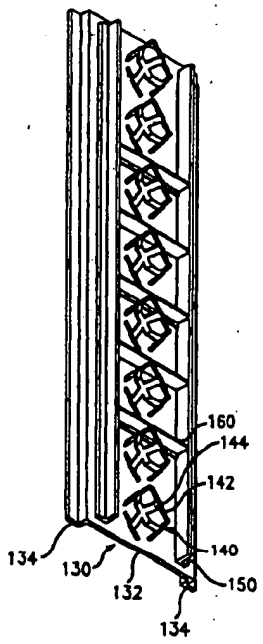
## (54) Dual polarization directional antenna having choke reflectors for minimizing side lobe

(57) The present invention is to provide a dual polarization directional antenna having choke reflectors for minimizing side lobe, including, a first reflection means for reflecting radiation energy; a plurality of radiation means for radiating energy in order to develop dual-polarization, the radiation means being arranged on the first reflection means; a main-power divider being supplied electric power from outer side power source thereof and distributing the electric power to each of the radiation means in a predetermined ratio; a plurality of sub-power dividers for transmitting the electric power distributed by the main-power divider to each of the radiation means; and a plurality of second reflection means for filtering and reflecting the energy radiated from the radiation means, and the reflection means being disposed on the first reflection means.

FIG. 3A




EP 0 973 231 A2

## Description

### Field of the Invention

[0001] The present invention relates to a dual polarization directional antenna using polarization diversity to prevent communication degradation by a fading in radio communication. More particularly, it relates to the dual polarization directional antenna having choke reflectors capable of obtaining a characteristic of a dual polarization by only one antenna.

### Description of the Prior Art

[0002] Hereafter, a directional antenna of prior art will be schematically described, referring to Figs. 1A and 1B.

[0003] Referring to Fig. 1A, the directional antenna of the prior art comprises a reflection plate 11 made of metal and a radome 12 disposed on the reflection plate 11.

[0004] Also, as shown in Fig. 1B, on upper surface of the reflection plate 11, a plurality of radiation units 13 and a power divider 14 are disposed. The power divider 14 supplies each of the radiation units 13 with electric power via distribution cables 15. Further, the radiation units 13, the power divider 14 and the distribution cables 15 are prptected from external environment by the radome 12.

[0005] The directional antenna of the prior art as described above has a characteristic of a single polarization. Therefore, at least two directional antennas are required in order to embody the characteristic of space diversity. Further, since distance between neighboring antennas within a base station is very near, the energy radiated from the side of the antennas has a harmful influence on adjacent antennas. That is, the energy radiated from the side of the antennas interferes between the neighboring antennas or causes call drops. Furthermore, total size of the reflection plate must be enlarged in order to improve horizontal beam width and front-to-back ratio, which are the characteristics of antenna, and wind load applied to the reflection plate is increased because the size of the reflection plate is large.

### Summary of the Invention

[0006] It is, therefore, an object of the present invention to provide a dual polarization directional antenna having choke reflectors capable of reflecting energy radiated from the side of the antenna in order to prevent interference between neighboring antennas.

[0007] Further, another object of the present invention is to provide the dual polarization directional antenna having choke reflectors capable of improving half-power width, front-to-back ratio and isolation by adjusting the position of choke reflectors without modifying total size of the antenna and decreasing wind load applied to the antenna by minimizing the size.

[0008] Furthermore, the other object of the present invention is to provide the dual polarization directional antenna having choke reflectors capable of obtaining characteristic of dual-polarization.

[0009] In order to accomplish the above objects, the dual polarization directional antenna having choke reflectors for minimizing side lobe comprises: a first reflection means for reflecting radiation energy; a plurality of radiation means for radiating energy in order to develop dual-polarization, the radiation means being arranged on the first reflection means; a main-power divider supplied electric power from outer side power source thereof and distributing the electric power to each of the radiation means in a predetermined ratio; a plurality of sub-power dividers for transmitting the electric power distributed by the main-power divider to each of the radiation means; and a plurality of second reflection means for filtering and reflecting the energy radiated from the radiation means, and the reflection means being disposed on the first reflection means.

### Brief Description of the Drawings

[0010] The advantage of the present invention will become apparent from the following description of the embodiment with reference to the accompanying drawings, in which:

Fig. 1A is a perspective view showing external appearance of the directional antenna of the prior art;
Fig. 1B is a perspective view showing inner structure of the directional antenna of the prior art;
Fig. 2 is a perspective view showing external appearance of a dual polarization directional antenna having choke reflectors for minimizing side lobe according to the present invention;
Fig. 3A is a perspective view showing inner structure of the dual polarization directional antenna having choke reflectors for minimizing side lobe according to the present invention;
Fig. 3B is a perspective view showing bottom surface of the dual polarization directional antenna having choke reflectors for minimizing side lobe according to the present invention;
Fig. 4 is a detail view showing radiation units of the Fig. 3A; and
Figs. 5A and 5B are detail views respectively showing main-power divider and sub-power divider for decreasing side lobe of the Fig. 3B.

### Detailed Description of the Invention

[0011] Hereafter, the present invention for embodying polarization diversity, by only one antenna, in frequency band of VHF(very high frequency), and UHF(ultra high frequency) and microwave will be described in detail with reference to the accompanying drawings.

[0012] As shown in Fig. 2, the dual polarization direc-

tional antenna having choke reflectors for minimizing side lobe of the present invention has a radome 110 and a plurality of connectors 120 exposed to external environment.

**[0013]** Further, as shown in Fig. 3A, the dual polarization directional antenna of the present invention comprises a folded reflection plate 130 disposed on lower portion of the radome 110, a plurality of radiation units 140(eight in the Fig. 3A) erectly disposed on upper surface of the folded reflection plate 130, two longitudinal choke reflectors 150 movably disposed on both sides of the radiation units 140 and a plurality of transversal choke reflectors 160 disposed between the two longitudinal choke reflectors 150.

**[0014]** The folded reflection plate 130 has a flat portion 132 and both folded portions 134 integrated with the flat portion 132. The folded portions 134 of the folded reflection plate 130 filter and reflect energy radiated from side of the antenna by the radiation units 140.

**[0015]** The radiation units 140 are arranged to space out predetermined distance from one another in order to improve isolation between polarizations of energy radiated from each of the radiation units 140. In this embodiment, the distance between neighboring two radiation units 140 is about 0.83 λ (wherein, the λ is wavelength). Further, each of the radiation units 140 has four coaxial dipoles 142 disposed on a supporter 144 made of conductive material. In this case, the four coaxial dipoles 142 are squarely arranged, each of the coaxial dipoles 142 is slantly positioned on 45 degrees to longitudinal axis of the folded reflection plate 130(see Fig. 4) and two of the four coaxial dipoles 142 function as input devices. Therefore, the radiation units 140 can have a characteristic of dual-polarization.

**[0016]** The choke reflectors 150 and 160 filter and reflect the sideward energy radiated from the antenna by radiation units 140. Therefore, the horizontal beam width of the antenna can be adjusted by moving the longitudinal choke reflectors 150.

**[0017]** Also, as shown in Fig. 3B, on bottom surface of the folded reflection plate 130, a main-power divider 170 and a plurality of sub-power dividers 180 are disposed. The main-power divider 170 is electrically connected to the sub-power dividers 180 via distribution cables 182, Further, each of the sub-power dividers 180 has a plurality of feeder portion 184 electrically connected to the radiation units 140.

**[0018]** The main-power divider 170 has first and second feeding ports 172 and 174, and the feeding ports 172 and 174 distribute electric power supplied to the main-power divider 170 through feeding cables 176 to the sub-power dividers 180.from outer side(see Figs. 5A and 5B). In this case, the first feeding ports 172 are connected to some of the sub-power dividers and the second feeding ports 174 are connected to the rest of the sub-power dividers. Further, the sub-power dividers connected to the first feeding ports 172 transmit the electric power distributed thereto to four radiation units positioned on the center of the flat portion 132 and the sub-power dividers connected to the second ports 174 transmit the electric power distributed thereto to the four radiation units positioned on the both side edges of the flat portion 132. In this case, the dual polarization directional antenna of the present invention can decrease side lobe by controlling a ratio of the electric power distributed to the first and second feeding ports 172 and 174. For example, when 60% of the electric power supplied to the main-power divider 170 is distributed to the first feeding ports 172 and 40% of the electric power is distributed to the second feeding ports 174, the electric power distributed to the first feeding ports 172 is supplied to the four radiation units positioned on the center of the flat portion 132 through some of the sub-power dividers 180 and the electric power distributed to the second feeding ports 174 is supplied to the four radiation units positioned on both side edges of the flat portion 132 through the rest of the sub-power dividers 180. As a result of this, the directional antenna of the present invention can decrease side lobe more than 16dB.

**[0019]** In the dual polarization directional antenna of the present invention as described above, the choke reflectors 150 and 160 filter and reflect the energy radiated from side of antenna of the radiation units 140 firstly. In this case, the horizontal beam width of the antenna can be adjusted by changing position of the longitudinal choke reflectors 150 so that the energy radiated from side of the antenna can be'minimized. Further, by the choke reflectors 150 and 160 operating as described above, the total size of the antenna can be minimized and the wind load applied to the antenna is decreased. Furthermore, all of the half-power width, the front-to-back ratio and the isolation of the antenna can be improved by moving the longitudinal choke reflectors 150 without modifying the size of the antenna.

**[0020]** Also, since the radiation energy radiated from the radiation units 140 is firstly attenuated by the choke reflectors 150 and 160 and be secondarily attenuated by the folded reflection plate 130, the energy radiated from side of the antenna is sufficiently decreased, and, therefore, it is possible that the interference Occurring between the neighboring antennas in a base station is minimized.

**[0021]** Furthermore, since it is possible to embody polarization diversity by only one directional antenna, the limited space on the base station can be effectively used and the cost for constructing the antenna system of the base station can be greatly decreased.

**[0022]** Although the preferred embodiments of the invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

## Claims

1. A dual polarization directional antenna having choke reflectors for minimizing side lobe, comprising:

   a first reflection means for reflecting radiation energy;
   a plurality of radiation means for radiating energy in order to develop dual-polarization, said radiation means being arranged on said first reflection means;
   a main-power divider being supplied electric power from outer side power source thereof and distributing said electric power to each of said radiation means in a predetermined ratio;
   a plurality of sub-power dividers for transmitting said electric power distributed by said main-power divider to each of said radiation means; and
   a plurality of second reflection means for filtering and reflecting said energy radiated from said radiation means, and said reflection means being disposed on said first reflection means.

2. The dual polarization directional antenna as recited in claim 1, wherein said first reflection means is a metal plate including a flat portion and folded portions integrated with said flat portion.

3. The dual polarization directional antenna as recited in claim 1, wherein each of said radiation means includes a supporter and a plurality of radiation devices disposed on said supporter in order to radiate said energy.

4. The dual polarization directional antenna as recited in claim 3, wherein each of said radiation means has four radiation devices,

   said four radiation devices are squarely arranged and are slant about 45 degrees to the longitudinal axis of said first reflection means.

5. The dual polarization directional antenna as recited in claim 1, wherein distance between neighboring two radiation means is about 0.83λ (wherein, λ is wavelength).

6. The dual polarization directional antenna as recited in claim 1, Wherein a plurality of said second reflection means includes a plurality of longitudinal choke reflectors movably disposed on both sides of said first reflection means in order to control horizontal beam width of the antenna and a plurality of transversal choke reflectors disposed between said longitudinal choke reflectors.

7. The dual polarization directional antenna as recited in claim 1, wherein said main-power divider distributes said electric power supplied thereto to said radiation means through said sub-power dividers, in a ratio of 6 to 4.

FIG. 1A
(PRIOR ART)

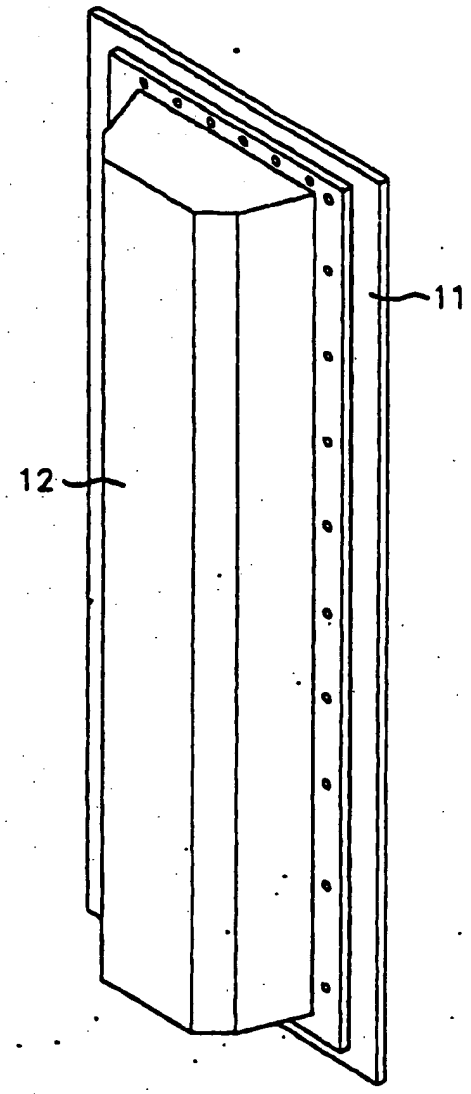


FIG. 1B
(PRIOR ART)

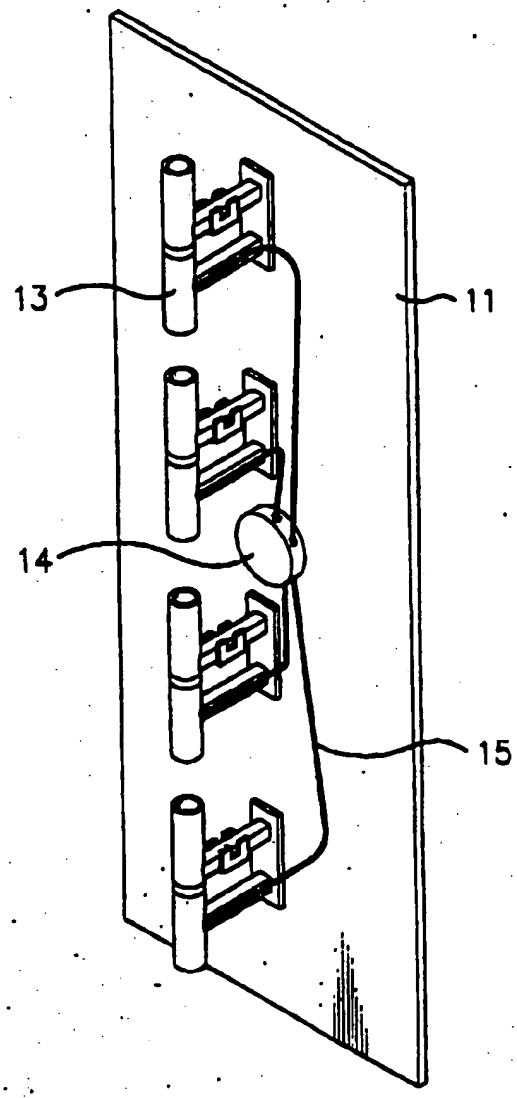


FIG. 2

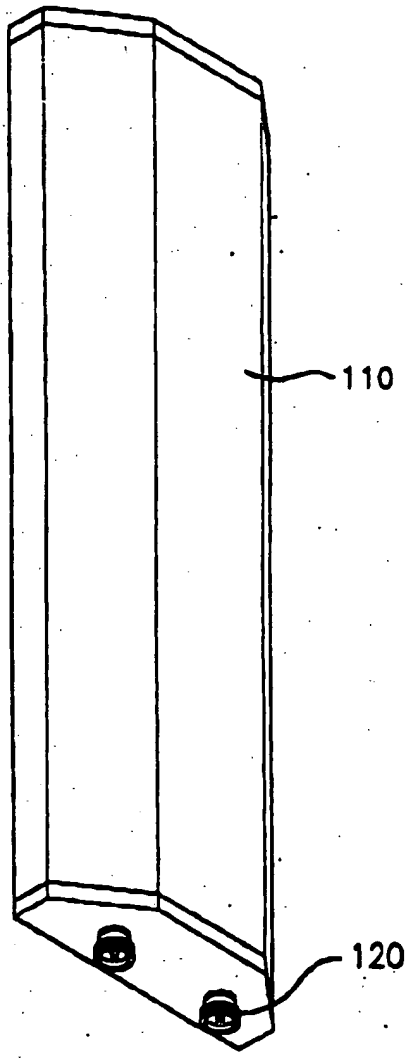


FIG. 3A

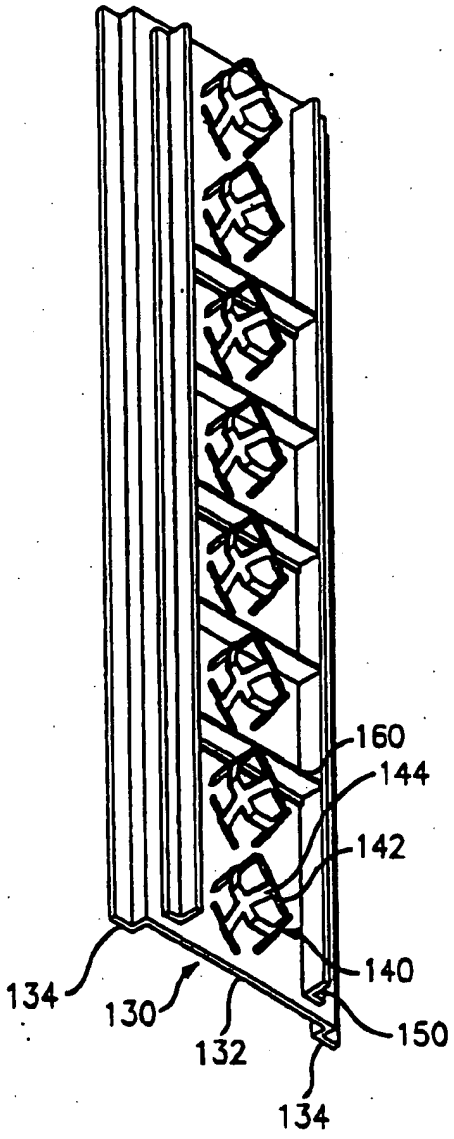


FIG. 3B

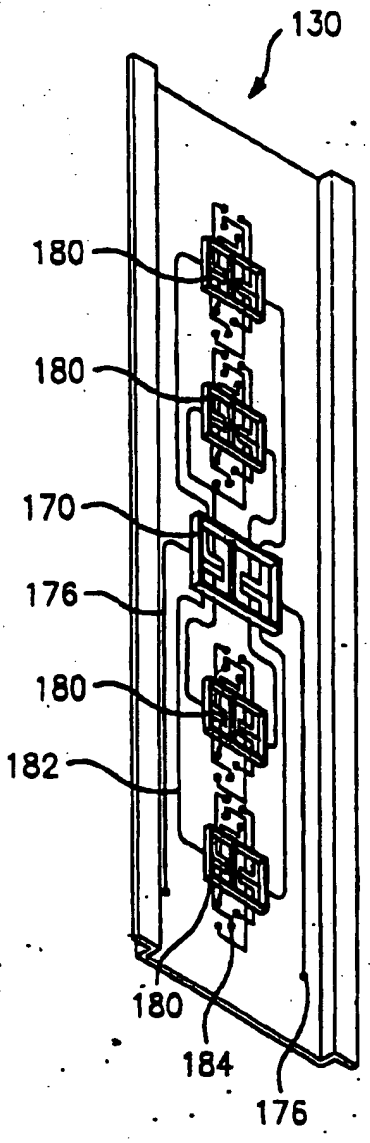


FIG. 4

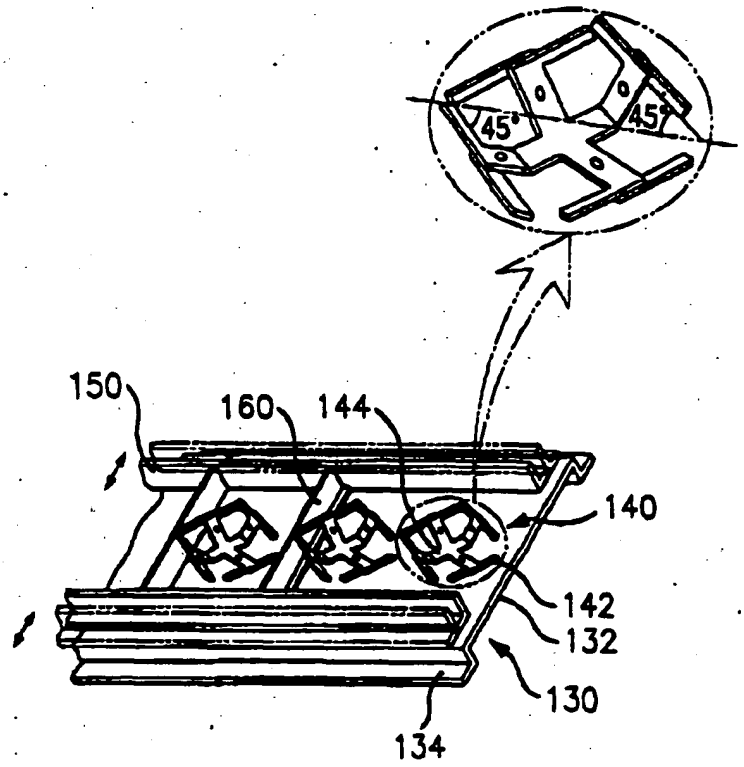


FIG. 5A

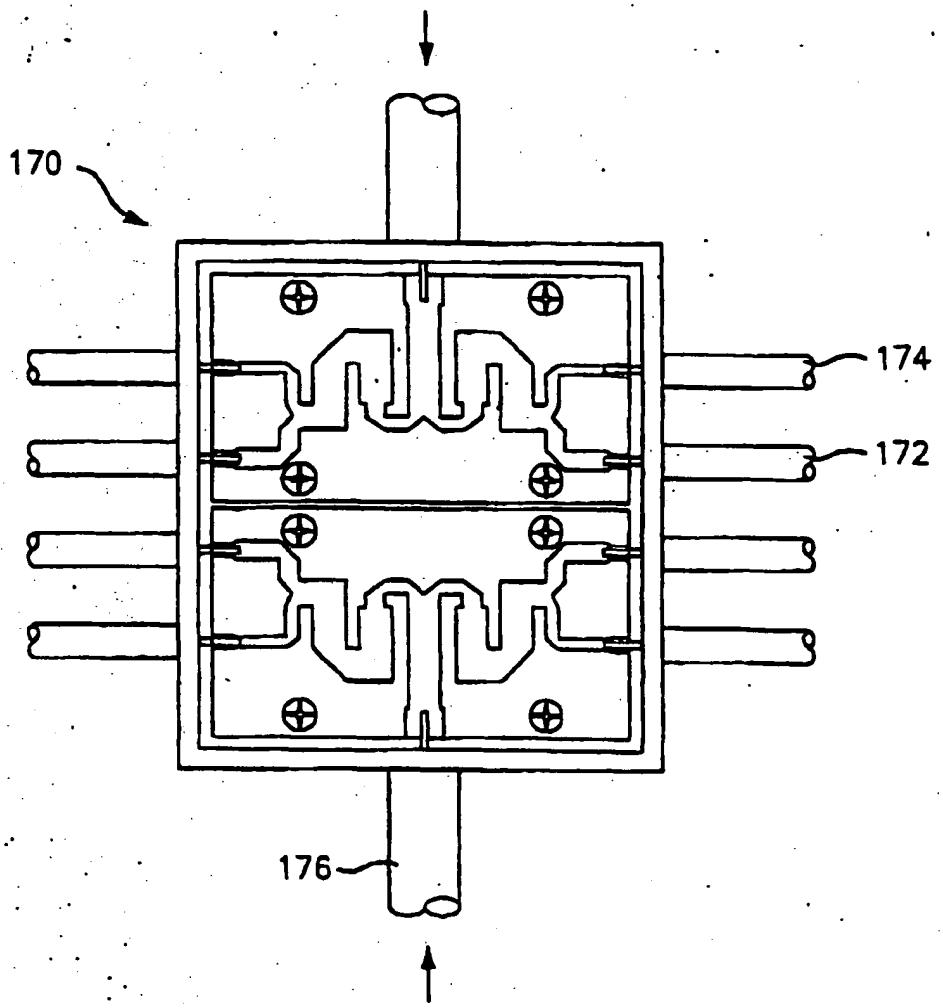


FIG. 5B